CLAIMS

We claim:

1. In a variable bandwidth wireless communication system capable of communicating under multiple different communication schemes that each have a different bandwidth, a process of generating an information bearing signal for wireless transmission, the process comprising:

utilizing a specified number of subcarriers to construct a channel with a particular bandwidth;

utilizing subchannels that include groups of subcarriers;

providing a fixed time-domain signal structure, including symbol length;

maintaining a substantially constant ratio between a sampling frequency and a size of FFT (Fast Fourier Transform) and IFFT (Inverse Fast Fourier Transform) or a fixed spacing between adjacent subcarriers;

adding or subtracting some of the subcarriers or subchannels to scale the channel and achieve a required bandwidth; and

wherein a core-band, substantially centered at an operating center frequency of the different communication schemes, is utilized for radio control and operation signaling, where the core-band is substantially not wider than a smallest possible operating channel bandwidth of the system.

2. The process of claim 1, wherein the wireless signal is:

transmitted by a mobile station in a multi-cell, multi-base-station environment;

a multi-carrier code division multiple access (MC-CDMA) or an orthogonal frequency division multiple access (OFDMA); and

utilized with downlink, uplink, or both, where a duplexing technique is either Time Division Duplexing (TDD) or Frequency Division Duplexing (FDD).

3. The process of claim 1, wherein the wireless signal has a primary preamble sufficient for basic radio operation, and wherein:

the primary preamble is a direct sequence in the time domain with a frequency content confined within the core-band or is an OFDM symbol corresponding to a particular frequency pattern within the core-band; and

properties of the primary preamble comprise:

a large correlation peak with respect to sidelobes, in case of an autocorrelation;

a small cross-correlation coefficient with respect to power of other primary preambles, in case of a cross-correlation with other primary preambles; and

a small peak-to-average ratio; and

wherein a large number of primary preamble sequences exhibit such properties.

4. The process of claim 3, wherein an auxiliary preamble, occupying the side-band, is combined with the primary preamble to form a full-bandwidth preamble in either the time domain or the frequency domain, wherein the side-band is the difference between the core-band and an operating bandwidth, and wherein:

the auxiliary preamble is either a direct sequence in the time domain with a frequency response confined within the side-band, or is an OFDM symbol corresponding to a particular frequency pattern within the side-band;

the full-bandwidth preamble allows a base station to broadcast the full-bandwidth preamble and a mobile station to use the primary preamble of the full-bandwidth preamble to access the base station; and

properties of the full-bandwidth preamble sequence comprise:

a large correlation peak with respect to sidelobes, in case of an autocorrelation;

a large ratio between the correlation peak and sidelobes, in case of a correlation with the primary preamble of the full-bandwidth preamble.

a small cross-correlation coefficient with respect to power of other full-bandwidth preamble sequences, in case of cross-correlation with other full-bandwidth preambles

a small cross-correlation coefficient with respect to the power of the full-bandwidth preamble, in case of cross-correlation with a primary preamble different from the primary preamble of the full-bandwidth preamble;

a small peak-to-average ratio; and

wherein a large number of full-bandwidth preamble sequences exhibit such properties.

5. The process of claim 1, wherein for a wide range of system bandwidths the bandwidth range is divided into smaller ranges, where the lowest range of bandwidth is a fundamental range and other ranges are higher ranges, and wherein in a higher range:

the sampling frequency is a multiple of the sampling frequency of the fundamental range and the corresponding FFT length is multiplied by a substantially same factor as the sampling frequency is multiplied by, to maintain time duration of the OFDM symbol structure;

the FFT length is maintained and the OFDM symbol duration is shortened accordingly; or

the FFT length is increased and the OFDM symbol duration is shortened accordingly; and

wherein the width of the core-band is less than or equal to a smallest bandwidth in the fundamental range.

6. In a variable bandwidth communication network of base stations and mobile stations, wherein a signal utilizes subchannels that include groups of

subcarriers, a method of adjusting a mobile station bandwidth to an operating bandwidth of a base station, the method comprising:

maintaining a fixed time-domain signal structure;

maintaining a substantially constant ratio between a sampling frequency and a size of FFT (Fast Fourier Transform);

adjusting a number of subcarriers or subchannels to scale a channel and attain a desired bandwidth;

utilizing a core-band, substantially centered at an operating center frequency, for radio control and operation signaling, wherein the core-band is not wider than a smallest possible operating channel bandwidth of the network; and

a configuration wherein the mobile station, upon entering an area, scans spectral bands of different center frequencies and upon detecting a signal in a spectral band of a center frequency:

determines the operating channel bandwidth by a center-frequency-to-bandwidth-mapping; or

decodes the bandwidth information provided to the mobile station via downlink signaling.

7. The method of claim 6, wherein the center-frequency-to-bandwidth-mapping employs a table look-up and the information provided to the mobile station via downlink signaling is in a broadcasting channel or preamble and is transmitted within the core-band.

8. The method of claim 6, wherein the signal is a multi-carrier code division multiple access (MC-CDMA) or an orthogonal frequency division multiple access (OFDMA), and the signal is utilized with downlink, uplink, or both, where a duplexing technique is either Time Division Duplexing (TDD) or Frequency Division Duplexing (FDD).

9. The method of claim 6, wherein the signal has:

a primary preamble, sufficient for basic radio operation, which is a direct sequence in the time domain with a frequency content confined

within the core-band or is an OFDM symbol corresponding to a particular frequency pattern within the core-band; and

an auxiliary preamble which occupies side-bands and is combined with the primary preamble to form a full-bandwidth preamble, and wherein the auxiliary preamble is either a direct sequence in the time domain with a frequency response confined within side-bands or is an OFDM symbol corresponding to a particular frequency pattern within side-bands, where the side-bands are the difference between the core-band and the operating bandwidth.

10. The method of claim 6, wherein for a wide range of operating bandwidths the bandwidth range is divided into smaller ranges, where the lowest range of bandwidth is a fundamental range and other ranges are higher ranges, and wherein in a higher range:

the sampling frequency is a multiple of the sampling frequency of the fundamental range and the corresponding FFT size is multiplied by a substantially same factor as the sampling frequency has been multiplied by, to maintain time duration of the OFDM symbol structure;

the FFT size is maintained and the OFDM symbol duration is shortened accordingly; or

the FFT size is increased and the OFDM symbol duration is shortened accordingly; and

wherein the width of the core-band is less than or equal to a smallest bandwidth in the fundamental range.

11. In a variable bandwidth communication network wherein a communication signal utilizes subchannels that are composed of groups of subcarriers, a mobile transceiver with an adaptable bandwidth, the transceiver comprising:

an analog-to-digital converter for signal sampling;

a Fast Fourier Transform and Inverse Fast Fourier Transform processor (FFT/IFFT), wherein a substantially constant ratio is maintained between a sampling frequency and a size of the FFT/IFFT;

a scanner for scanning spectral bands of specified center frequencies, upon entering an area, to find a signal and to determine an operating channel bandwidth;

a facility for sustaining a core-band for pertinent communications, wherein the core-band is not wider than smallest possible operating channel bandwidth of the network; and

a facility for adding to the subcarriers to widen the channel bandwidth for remainder of the communication.

12. The transceiver of claim 11, wherein the center-frequency-to-bandwidth-mapping employs a table look-up and the information provided to the mobile transceiver as downlink information is in a broadcasting channel or preamble.

13. The transceiver of claim 11, wherein the signal is a multi-carrier code division multiple access (MC-CDMA) or an orthogonal frequency division multiple access (OFDMA), and the signal is utilized with downlink, uplink, or both, where a duplexing technique is either Time Division Duplexing (TDD) or Frequency Division Duplexing (FDD).

14. The transceiver of claim 11, wherein for a wide range of operating bandwidths the bandwidth range is divided into smaller ranges, where the lowest range of bandwidth is a fundamental range and other ranges are higher ranges, and wherein in a higher range:

the sampling frequency is a multiple of the sampling frequency of the fundamental range and the corresponding FFT/IFFT size is multiplied by a substantially same factor as the sampling frequency is multiplied by, to maintain time duration of the OFDM symbol structure;

the FFT/IFFT size is maintained and the OFDM symbol duration is shortened accordingly; or

the FFT/IFFT size is increased and the OFDM symbol duration is shortened accordingly; and

wherein the width of the core-band is less than or equal to a smallest bandwidth in the fundamental range.

15. The transceiver of claim 11, wherein the transceiver is a mobile station and the communication network is a wireless network of base stations and mobile stations.

16. The transceiver of claim 11, wherein the signal has:

an essential preamble, sufficient for basic radio operation, which is a direct sequence in the time domain with a frequency content confined within the core-band or is an OFDM symbol corresponding to a particular frequency pattern within the core-band; and

an auxiliary preamble which occupies side-bands and is combined with the essential preamble to form a full-bandwidth preamble, and wherein the auxiliary preamble is either a direct sequence in the time domain with a frequency response confined within side-bands or is an OFDM symbol corresponding to a particular frequency pattern within side-bands, where the side-bands are the difference between the core-band and the operating bandwidth.

17. The transceiver of claim 11, wherein the transceiver uses the core-band during an initial communication stage and the operating bandwidth during normal operation, and wherein upon entering into an area, the mobile transceiver starts with the core-band and switches to the operating bandwidth for additional data and radio control subchannels.

18. An apparatus for use in a communication system, the apparatus comprising:

a mobile station with an FFT (Fast Fourier Transform) facility configured to:

divide a wide range of operating bandwidths into smaller bandwidth ranges, wherein a width of a predetermined band for basic system information communication is less than or substantially equal to the smallest operating bandwidth of any of the bandwidth range, and wherein in a bandwidth range:

a sampling frequency is a multiple of a sampling frequency of the lowest bandwidth range and the FFT is sized corresponding to the sampling frequency, to maintain time duration of an OFDM symbol structure;

the FFT size is maintained and the OFDM symbol duration is shortened accordingly; or

the FFT size is increased and the OFDM symbol duration is shortened accordingly;

scan spectral bands, when entering an area, to determine the operating bandwidth upon detecting a signal in a spectral band; and

switch to the operating bandwidth by adding subcarriers to transmitting signals, wherein a specified number of subcarriers form a channel with a particular bandwidth.

19. The system of claim 18, wherein determining the operating bandwidth is by table look-up or down-link signaling.

20. In a variable bandwidth communication network of base stations and mobile stations, wherein a signal utilizes subchannels that include groups of subcarriers, a means for adjusting a mobile station bandwidth to an operating bandwidth of a base station, the means comprising:

means for maintaining a fixed time-domain signal structure;

means for maintaining a substantially constant ratio between a sampling frequency and a size of FFT (Fast Fourier Transform);

means for adjusting the number of subcarriers or subchannels to scale the channel and attain a desired bandwidth;

means for utilizing a core-band, substantially centered at an operating center frequency, for essential communications, wherein the core-band is not wider than smallest possible operating channel bandwidth of the network; and

means for scanning spectral bands of different center frequencies, detecting a signal in a spectral band of a center frequency, and determining the operating channel bandwidth of an area.

21. In an adaptive variable bandwidth wireless communication system capable of communicating under multiple different communication schemes that each have a different bandwidth, a signal for wireless transmission, the signal comprising:

subcarriers, wherein a specified number of subcarriers constitute a channel with a particular bandwidth;

a fixed time-domain signal structure;

a core-band utilized for radio control and operation signaling, where the core-band is substantially not wider than a smallest possible operating channel bandwidth of the system; and

a configuration wherein:

a substantially constant ratio between a sampling frequency and a size of FFT (Fast Fourier Transform) and IFFT (Inverse Fast Fourier Transform) of the signal or a fixed spacing between adjacent subcarriers is maintained; and

at least some of the subcarriers are added or subtracted to scale the channel and achieve a required bandwidth.